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The Development of Mobile Application for College Event Attendance System

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Abstract: Events organised by students' residential colleges require the participants to sign in to the event. The existing sign-in system is by taking attendance manually, and the attendance records are stored in a physical file. Therefore, the objective of this study is to develop a mobile application to automate the signing process and events' data management. This study is motivated by the lengthy waiting time for participants to stand in a long queue and manually sign on a piece of paper. The attendance paper is then stored physically in a file, which is exposed to misplacement, damage, and loss. Additionally, retrieving and analysing attendance and event data also becomes cumbersome when the physical file must be manually sorted. To overcome these problems, College Events Attendance Monitoring System is developed by following the Waterfall model, which has a stable cycle of development where the phases are carried out sequentially. Event organisers can add, edit, and delete events' data from the system. Students can register as participants to an event, sign in to the event, rate the event, and see the history of events attended through the mobile app. As part of the security, user registration authentication is ensured through One-Time Passwords (OTPs). End-user evaluations indicated high satisfaction with the app's features and usability.

Keywords: Attendance system, Event attendance, Mobile application, OTP

1 Introduction

Attendance is the concept of people, individually or as a group, appearing at a location for a previously scheduled event. Measuring attendance is a major concern for many organisations that use this information to determine the success of their activities and schedule future initiatives. In a classroom setting, taking attendance is an important step in monitoring students' activities and ensuring the students are eligible to complete the course. While in an event, attendance is taken so that the organiser can measure the success of the event organised and do some analysis from the event data. Despite the advancement of technology, most educational institutions are still using the old registering system [1]. In addition, as one of the necessities, participants who attend events or programs managed by the university must also be enrolled as students in the university.

In recent years, there have been a lot of mobile applications available to complement our daily work. However, applications for attendance-taking on smartphones have rarely been used [2]. Educational institutions, particularly colleges and universities, are also embracing the potential of mobile applications to enhance their systems and processes. One area that stands to benefit significantly from such innovation is the management of event attendance within students' residential college communities. When the event to be held is on a large scale, it is critical to register a large number of students without them spending so much time queuing up. It is indispensable to deploy a speedy check-in or attendance solution in this situation. Both parties, the event's organiser and the participants, will obtain advantages through a mobile application that can handle attendance data. All data related to the events are permanently stored and organised neatly in the database. Consequently, managing and sorting the attendance and event data for further analysis can become easier.

With the usage of smartphones reaching almost 100% in Malaysia [3], and the majority of university students do have smartphones, thus, it might be very effective to use mobile applications for taking attendance. Therefore, this research is aiming at developing a mobile application that can reduce the time of queuing for registration and signing-in processes. Furthermore, the management of an event's data can also be improved in terms of its efficiency, accuracy, and security since data is stored in the databases.

2 Literature Reviews

A Event and Attendance

An event is a scheduled and arranged activity such as a social gathering or a performance such as musical theatre, comedy shows, and so on. A good event requires an organiser to gather big crowds [4]. The event is managed by the event organiser before and after the event takes place. That is why the organiser has a big, important role to play in making the event run smoothly.

Commonly, attendance is important in education, work, entertainment, and many social settings. For education and work, attendance is important because it will affect students' performance at school or university. Students' attendance in class might have an impact on their marks and other assessments. Poor attendance can indicate that a student's situation is a problem, as well as a failure to learn the knowledge and skills needed for future success. Therefore, long-term investments in increasing student attendance will contribute to better academics, with a focus on reducing future grade dropout levels for students [5]. Students in elementary and high school may be required to attend, while students in higher education may be penalised by lecturers or the institution if they fail to do so. Attendance is important to prove that students had attended the event, and their name had been recorded in the system.

Research by [6], [7], and [8] discussed the importance of attendance as a measurement in entertainment and commercial environments to determine the success of a program. Attendance at other activities such as films, plays, and stage performances can also influence whether a product is commercially successful, as well as whether sequels or related works are to be made. Furthermore, anticipating such high levels of attendance at an event is a major role in determining the number of seats to be placed in facilities specifically constructed for such events and sharing activities. When an event occurs, such as a game during a sporting season or concerts or performances, the goal should be to increase attendance by extending the performance to fewer common days or to extend the performance over a longer period. Attendance is also tracked and reported at a variety of other social gatherings, including public gatherings.

B Mobile Application-based Attendance

There are many mobile applications developed for managing attendance. Student attendance system developed by authors in [9] is a simple mobile application that allows students to first register their courses for the semester. Then, the students can sign in to the class attended. The attendance record is stored in the database and can be viewed only by the university administrator. The authors in [10] developed an Android application for employee attendance. The mobile application captures the employee's location to verify that the employee is within the boundary permitted to avoid having the employee signing-in outside of the office area. This was achieved by implementing geofencing technology. The application also provides attendance data for viewing purposes. QR-Codes have also been implemented in automated attendance systems. A research by [11] developed a system for attendance-taking in classrooms at their university. The system consists of 2-tier applications, which are server and mobile modules. The server modules processed students' attendances, student details, subjects, timetables, and interacted with the mobile module on students' smartphones. Whereas the mobile module consists of two main modules, which are the students' registration module and the attendance-taking module. During class, the server will generate a QR code, and then students are able

to scan the QR code to validate their presence in the class. The system's server will check all related data and verify the student's attendant.

C Similar and Existing Event Management Mobile App

Three mobile applications that are currently available were used to compare with the proposed mobile application. The mobile applications are EventMobi [12], Whova [13], and Attendify [14]. Comparison were made on the main features of the mobile applications, as shown in Table 1.

Table 1: Comparison of proposed mobile application with current mobile applications

Features	EventMobi	Whova	Attendify	Proposed System
Account registration and authentication method	Email and password	Email and password	Email and password	Form and OTP
Event data management (add, update, delete)	Yes	Yes	Yes	Yes
Register and participate in event	Yes	Yes	Yes	Yes
Check-in method	QR code, Manual check in	QR code, Manual check in	QR code, Manual check in, face recognition	Event's access code
Event merit point method	Gamification	Leaderboard	Gamification Leaderboard	Merit point is given for joining the event based on college requirements.
Event rating	Yes	Yes	Yes	Yes
List of upcoming events	Yes	Yes	Yes	Yes
List of events in the past	Yes	Yes	Yes	Yes
Pricing and cost	Starts from USD2500	Starts from USD1500	Starts from USD1999	Free

The proposed mobile application is aiming at simplicity of use that meets the requirements of the residential college at UiTM Kelantan Branch, Machang Campus, such as assigning merit points to attendees, simple sign-in, and low cost. Every semester, residential colleges organise events such as dinners, meetings, sports days, and many more interesting events that students can join. By joining the events, students are awarded merit points to be collected. The merit points can be used as one of the qualifications for applying residential colleges for next semester. For user registration in the mobile application, OTP is used to verify the students' phone number. A simple sign-in method is applied for the students to check in during the event. An event access code is given during the event so that students can prove their presence. Access code is just a specific and unique number given by the organiser during the event.

3 Method

This research project is for mobile application development. Therefore, the methodology used in this project was based on software development methodology. There are a few development models that can be used, such as the waterfall model, spiral model, V-shaped model, and rapid development of applications model (RAD). For this project, the waterfall model introduced by [15], [16], and [17] was used. This software methodology was chosen because it follows the step-by-step process of development, where a phase must be completed before a new phase starts. It consists of a detailed plan that describes how specific software can be developed, maintained, replaced, modified, or enhanced. The life cycle is shown in Figure 1. The process aims at producing high-quality software that meets the expectations of the customers.

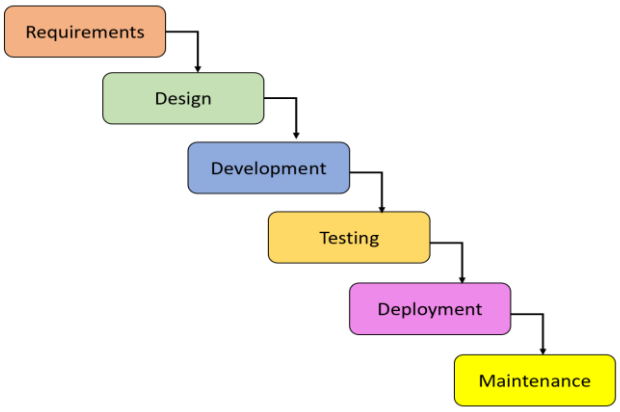

Figure 1: Waterfall Model

A Requirements

The requirements of the mobile application were obtained from literature, the current system that has been developed, and from users. The mobile application has two categories of users: event participants and event organisers. User requirements are detailed as follows:

Table 2 List of requirements for event organisers and event participants

Event Organizer	**Event Participant**
Login/forget/reset password	Login/forget/reset password
Register as organizer	Register as participant
Verify registration with OTP	Verify registration with OTP
Register new event to organize	Display list of events from organizer
Display event registered	Search list of events from organizer
Search the list of events	Register and sign to the event attended
Delete event registered	Rate the event attended
View event's participants	Display history of event attended
View rating of an event	View or update profile
Assign merit for an event	

Table 3 and Table 4 show the hardware and software requirements for the development:

Table 3 Minimum Requirements of a Computer

Hardware	**Specifications**
Computer	Processor: Intel ® Pentium ® Silver N5030 CPU @ 1.10GHz RAM: 4.00GB System type: 64-bit operating system, x64-based processor
Smartphones	Android

Table 4 Software Requirements

Software	**Descriptions**
Android Studio	It will be used to write coding and design interfaces for the mobile application.
Firebase	It will be used to handle the server's database.

B Design

To define the structure, behaviours, and view of the mobile app, a system architecture is drawn as shown in Figure 2. The architecture was drawn according to the requirements that had been gathered in the previous phase.

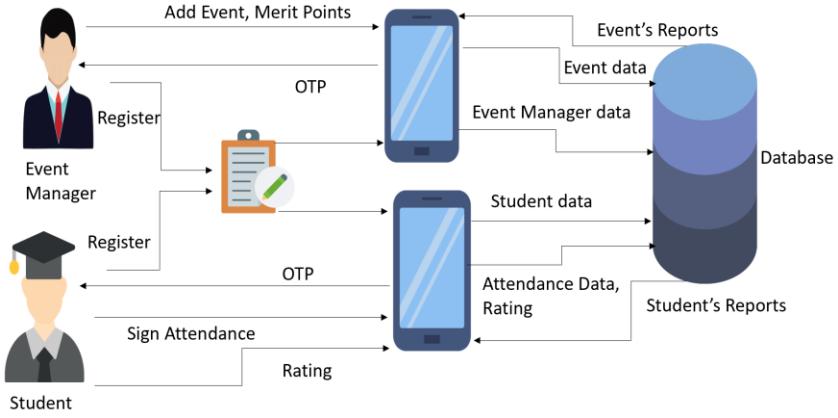

Figure 2 System Architecture

In this architecture, the mobile application has two users, an event organiser and a student as event participant. The event organiser can register with the system; the data is stored in the database, and then the registration is verified through OTP. Generally, tasks that the event organiser can do are related to the management of the event's data, including adding a new event, assigning merit points to the event, deleting an event, searching, and displaying a list of events. The organiser can also view a list of participants who attended the event and view ratings given by the participants to the event.

Students can enrol in the events in the mobile application by first registering themselves as participants. Upon successful registration, an OTP will be sent to verify their registration. Students' data are stored in the database. Students can login to the mobile application and choose to attend the events. When attending the events, students can sign the attendance by using the mobile application. After the event, students can give ratings based on their experience and satisfaction. The mobile application also has a feature for the students to view all events attended, and they can also update their profile.

Additionally, database design is also presented with the ERD diagram shown in Figure 3. There are five tables identified for the mobile application. Every table has its own specific attributes. These attributes represent the data that will be stored in every table.

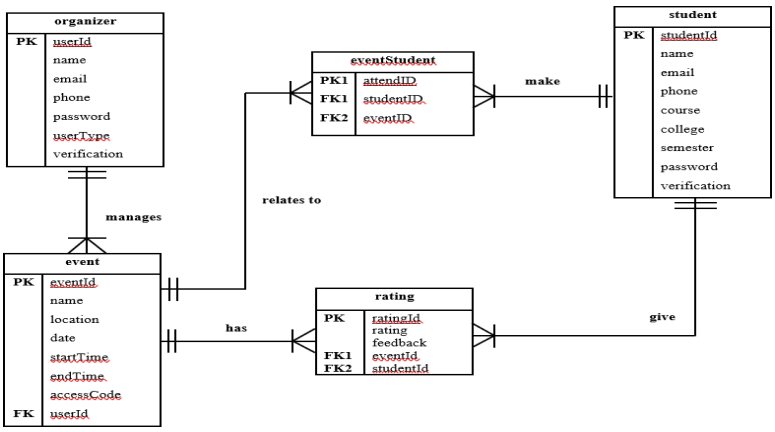

Figure 3 ERD for College Event Attendance Monitoring System

There are three main tables, which are organiser, student, and event. The organiser table stores name, email, phone number, password, user type, and verification (OTP) as the attributes of the table. The student table has attributes of student ID, name, email, phone number, course, college, semester, password, and verification (OTP) as the data in the table. The event table stores data like event ID, name of event, location, date, and start time and end time access code as the data in the table.

C Development

During the third phase, namely implementation, the development of the mobile application consists of two main tasks. The first task is to implement the database structure according to the design in the previous phase. The implementation is shown in Figure 4.

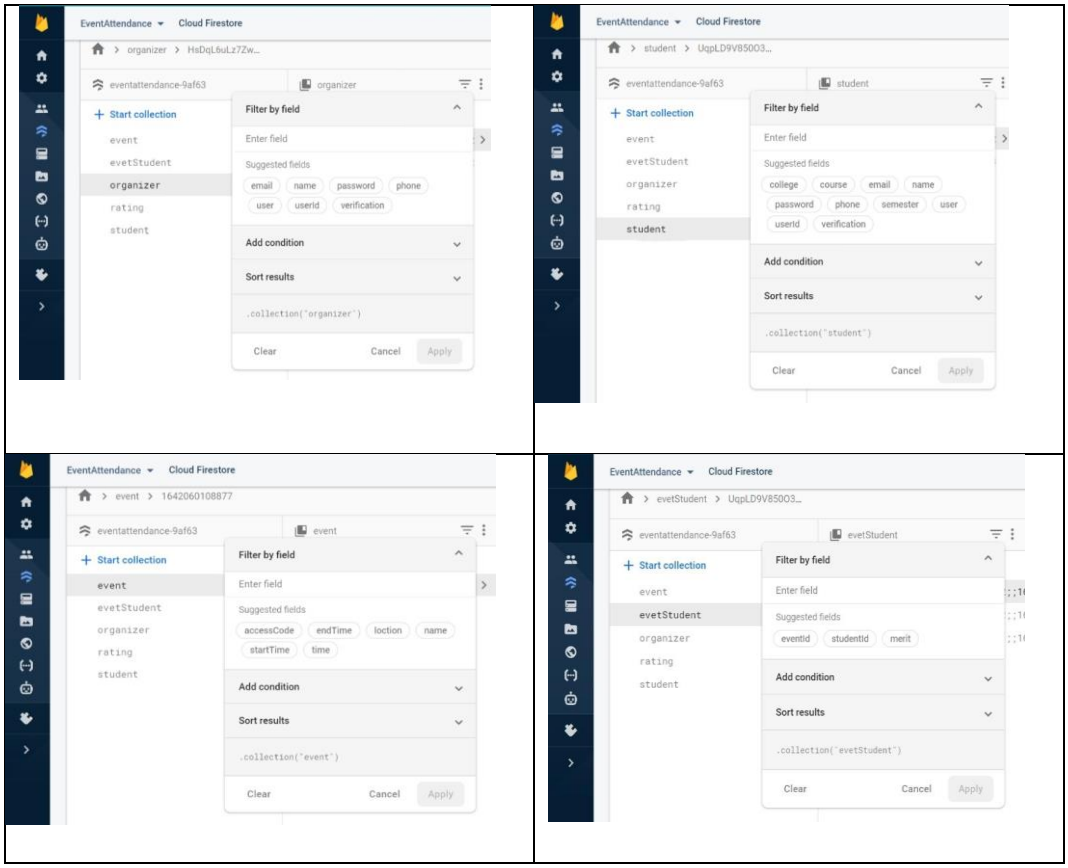

Figure 4 Database Implementation

The mobile application for event attendance is developed for the Android platform. Therefore, it is developed by using Android Studio as the development environment. Android Studio is an IntelliJ IDEA-based integrated development environment (IDE) for Android application development. Android Studio is more than just an IntelliJ code editor and powerful development tool; it also includes features like a flexible Gradle-based version system, a fast and feature-rich emulator, and instant run, which allows making changes to running applications without having to create a new APK.

This project takes advantage of Firebase Authentication's PhoneAuthProvider to make it easier to deliver OTP to users' phone numbers and confirm the OTP entry. In order to integrate phone number authentication in the Android application, the PhoneAuthProvider provides a quick and safe solution. The following statement shows the dependencies implementation of Firebase console.

```
//Firebase console
implementation 'com.google.firebase:firebase-auth:22.1.0'
implementation 'com.google. android.gms:play-services-auth:22.1.0'
```

The statement below shows the permission implementation for *SEND_SMS*.

```
<uses-permission android:name="android.permission.SEND_SMS"/>
```

D Testing

Testing must be done once the application has been properly developed to check that it is working as planned. This is also to ensure that the system satisfies previous requirements. Two types of testing were used for this project to make sure it is working properly and does not have errors. Functional testing is a sort of software testing that evaluates a software system's functionality against functional requirements and specifications [19]. Table 5 below lists all the functionality that has been tested.

Table 5 Functional Testing

No	Functions	Expected Result	Result
1	Register	Users can key in their details and an account will be created.	Pass
2	OTP for verification	Users will receive OTP for registration verification through sms.	Pass
3	Log-in and reset password	Users can login into the application after keying in the username and password. Users can also reset passwords if forgotten.	Pass
4	Add, display, delete and search	Event manager can add new events, display list of events, delete specific events and search listed events.	Pass
5	Merit points	Event manager can assign merit points between 1 to 10 to participants. Participants can view the merit points they have obtained.	Pass
6	Sign in to event	Participants can sign in to the event attended during the event.	Pass
7	Event rating	Participants can rate the event attended by giving 1 to 5 stars. Event Manager can view the rating report.	Pass

Testing for OTP functionality was carried out to ensure the application can receive OTP accordingly. The users should receive an OTP to verify their identity during account registration. The OTP Verification will be sent by Short Message Service (SMS), and they have to insert the OTP Verification in the form. The OTP Verification has a 6-digit number. Figure 5 shows the OTP Verification Page that needs users to verify.

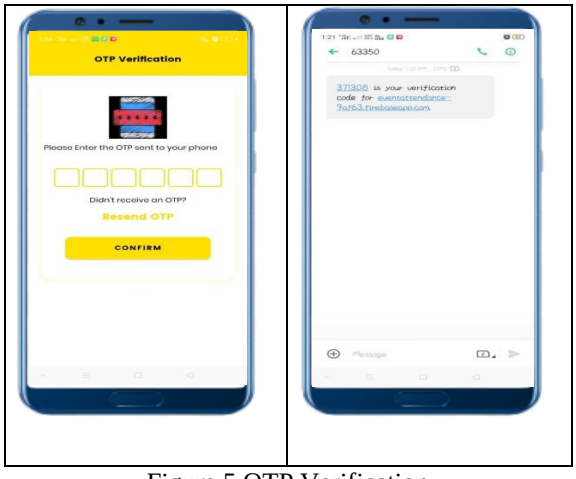

Figure 5 OTP Verification

The other crucial function that must be tested is the sign-in page. Figure 7 shows the form for the sign-in attendance page. In the form, it will display the event's details, and students only need to insert the access code of the event. Event access code is used to ensure that students do not cheat, like filling in attendance, but they are not at the location while the event is going on. Then, students need to click the button to attend the event. After clicking the button, it will display the toast message "Event Joined" shown in Figure 6.

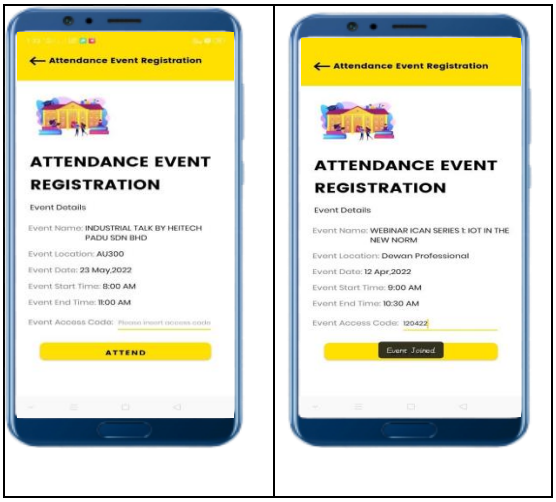

Figure 6 Sign in to the event attended

Usability testing was also carried out during this process. Users need to answer the questions that were listed in the questionnaire after they have used this system. Table 6 shows the types of questions being asked to the users.

Table 6 Question Categories for Usability Testing (UT)

User Interface Design	**Usefulness and Ease of Use**	**Usability**
Clear and comprehensible background and text	No need for manual attendance, reduce time of queueing, only use smartphone, helpful	Enough functions, all functions workable, satisfied

4 RESULTS

A The Mobile Application

Figure 7 shows the main page for the College Event Attendance Monitoring System. There are two login buttons created on the main page. There is a login button for the event organiser and a button for students. If the user was the participant, the user must log in as a student. Another login button was for the event organiser, who was responsible for organising and handling the event before and after it had occurred.

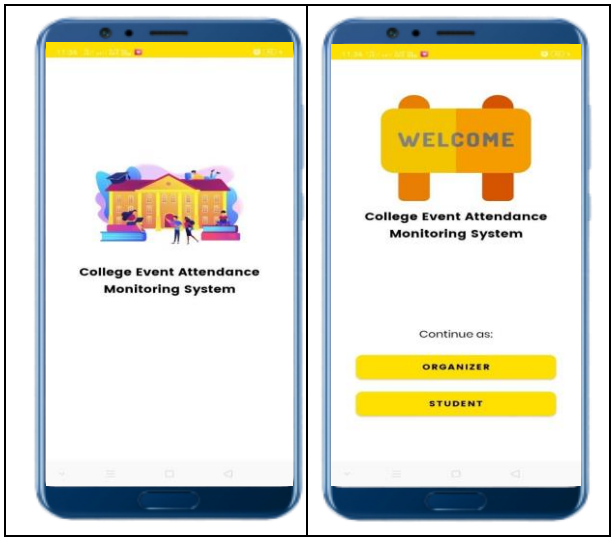

Figure 7 Welcome Page

Figure 8 shows the registration form for the organiser to register the system. Users must fill in the field and press the register button. They will log in and access the system when the information has been saved into the database. The registration process is a compulsory process for this application. Users need to fill out the form by registering their user ID, which is their staff ID, name, email, phone number, and password. Two users handle the organiser page, whether staff or students. So, they need to choose whether they register as staff or students. As a security measure, the user must verify their identity. The OTP verification will be sent thru SMS, and they must insert the OTP verification in the form. The OTP verification has a 6-digit number.

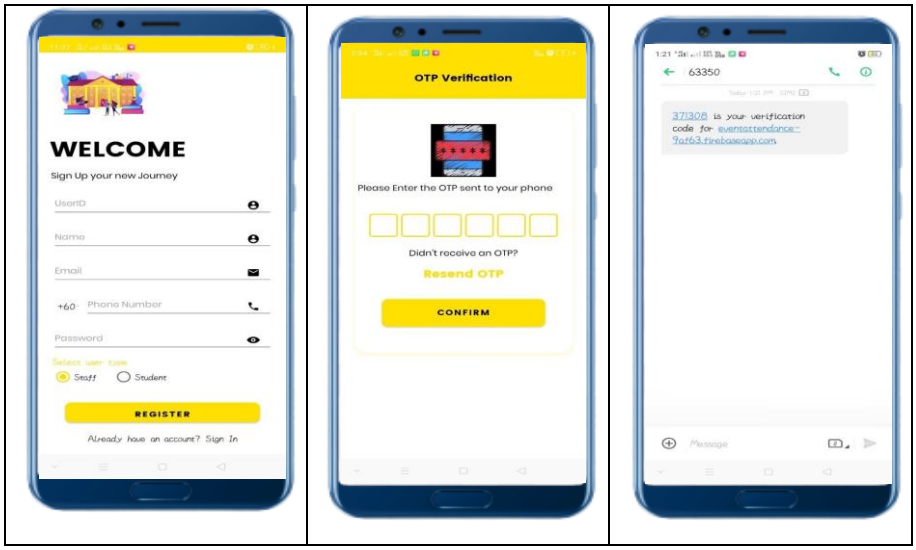

Figure 8 Register and OTP Verification Page for Organiser

The organiser's main page is shown in Figure 9. On this page, it has six tabs, which are home, list of events, event registration, student report, about us, and logout. Each menu has its own features in this system. The most important feature on this page is the event registration. On this page, organisers can add a new event that they are going to organise, fill in the details about the event, and set the access code to avoid cheating during signing attendance. The organiser can view a report on students who attended the event, then give merit points as an award for participating in the event.

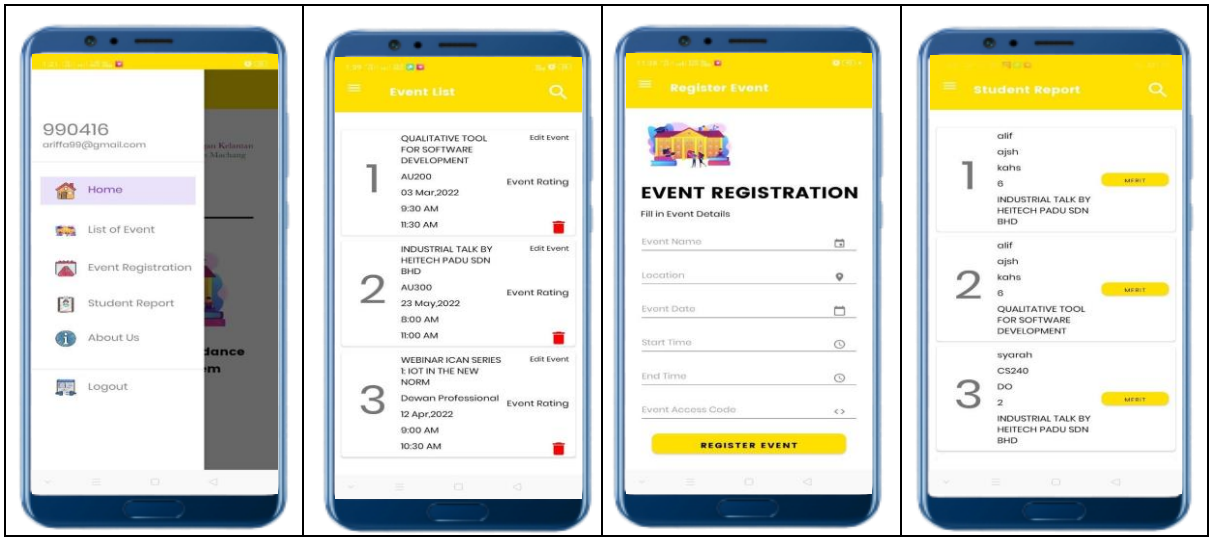

Figure 9 Pages for Organiser

The student's menu page is shown in Figure 10. On this page, it has six tabs, which are home, profile, list of events, history event, about us, and logout. Each menu has its own features in the mobile application.

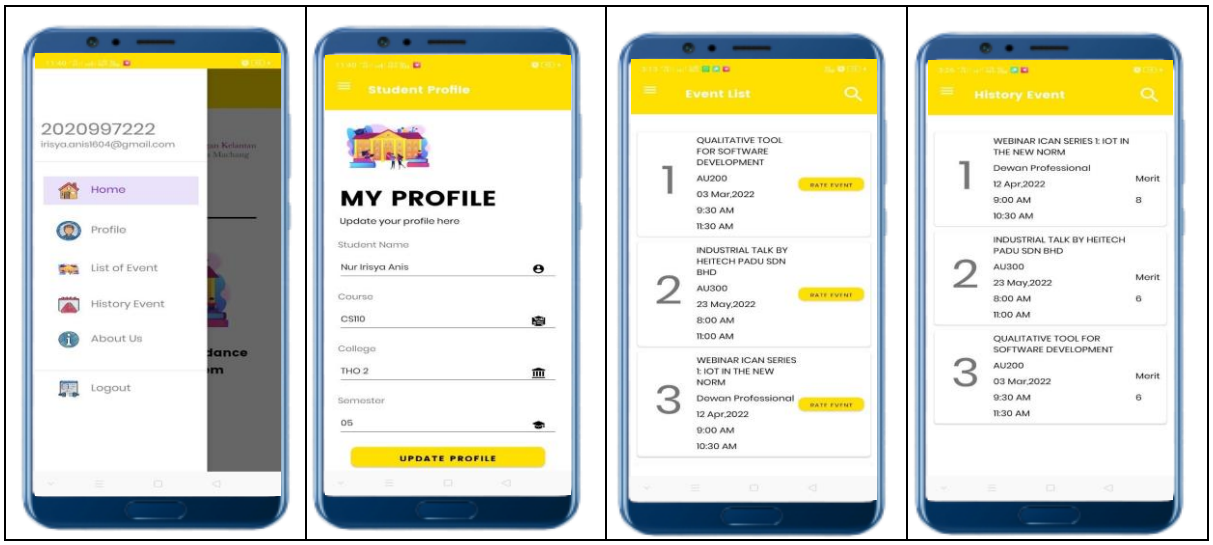

Figure 10 Pages for Students

Figure 11 shows the form for taking attendance. In the form, it will display the event's details, and the students only need to insert the access code of the event. Event access codes will ensure students do not cheat, like filling in attendance but they are not at the location while the event is going on. Then, the students need to click the button to attend the event. After clicking the button, it will display the toast message "Event Joined". Lastly, students can give a rating to the event attended. They must rate by clicking on "star", and they can write their feedback on the program attended.

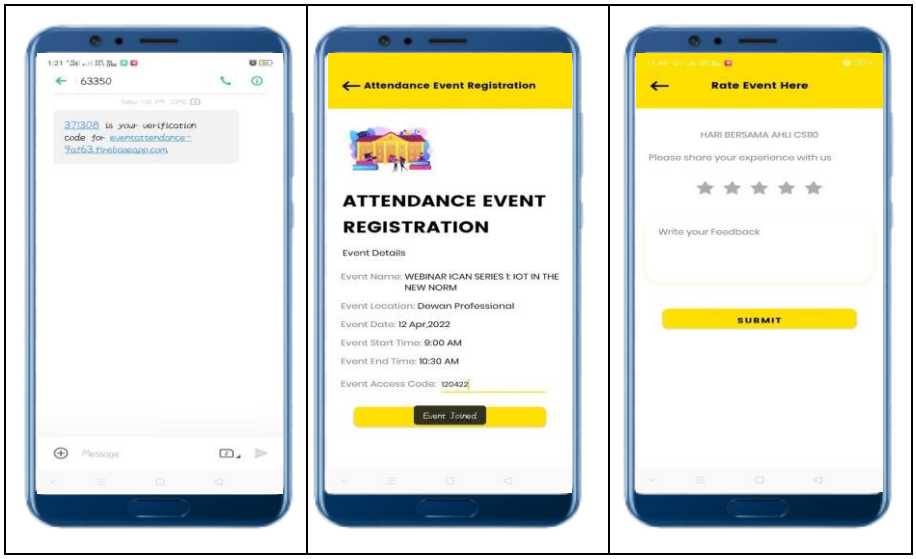

Figure 11 Page to Sign the Attendance and Rate the Event

B Usability Testing (UT)

The UT was carried out by 25 respondents who were randomly selected from UiTM Kelantan Branch, Machang Campus. In the survey, they were given the application. They can use and evaluate it for user acceptance testing. Then, the respondents were given survey questionnaires. Respondents must answer the questions based on the scale given: 1-Strongly Disagree, 2-Disagree, 3-Neutral, 4-Agree, and 5-Strongly Agree.

Table 7 Result of Usability Testing

User Interface Design	Usefulness and Ease of Use	Usability
4.47	4.53	4.47

The result of UT is shown in Table 7. For user interface design of the application, the means score was 4.47 points. The application is also evaluated as useful and easy to use, as the mean score for this feature was 4.53. Lastly, the questions in category usability scored 4.47. Therefore, it can be concluded that the application meets the requirements and satisfies the users.

5 CONCLUSION

In conclusion, the College Event Attendance Monitoring System is a mobile application developed to help the organiser organise and manage the event. Whereas for event participants, the mobile application reduces the time taken for registering the event, signing attendance, and helping them manage their activities in college. Development of the mobile application was based on requirements gathered, which were then translated into a design. The final College Event Attendance Monitoring System was measured by using user acceptance testing. Most of the respondents were contented with the function and achievement of this system. However, several functions need to be improved.

There are some recommendations for future works of the system that were discovered after the system was finished and put to test. The strengths and weaknesses of the system were gained from the feedback by the respondents in the survey. The first recommendation for the application was to add more features to the system. The respondents suggested adding some features, such as notifications for

upcoming events, on the student's page. This is because the notification function makes students aware of the upcoming event. Besides, the respondents also suggested adding GPS to track the location of students during the event to prevent student absence. Next, the respondents also suggested making a unique access code for every student. So that they do not cheat by asking a friend for the access code. Often, they cheat when signing attendance because they want to get extra points to be able to stay in college for next semester.

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